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Note on the Observations for Coincidence of the Collimators through the Cube of the Transit Circle at the Royal Observatory, Greenwich. By H. H. Turner, B.A., B.Sc.

For some time after the erection of this instrument, observations for coincidence of the Collimators could only be made after first raising the instrument, so that the view of one Collimator by the other was uninterrupted. In 1866 December, however, the central cube of the Transit Circle was perforated so that when the instrument was placed vertical a view of the South Collimator by the North could be obtained through eight holes of sector form, symmetrical about the common axis of the Collimators. The radial bars separating these sectors were not cut away in the hope of avoiding any serious interference with the rigidity of the cube, although this prevented the use of the central portions of the object-glasses of the Collimators in the observations. It was noticed soon afterwards that there was a small discrepancy between the readings for coincidence of the North Collimator on the South obtained when the Transit Circle was raised as before, and those obtained by this new method of viewing; but Sir George Airy, in commenting on it in his Report to the Board of Visitors in 1868, expressed some scepticism as to the reality of the discrepancy, and was more inclined to attribute the apparent discordance to "an erroneous habit in the application of the eye to the eye-glass, combined with a very small error of focal adjustment." The results of a number of observations in 1869 and 1870 were collected, however, and the mean difference of readings of the micrometer of the North Collimator was found to be $0^{r}\cdot020$ and $0^{r}\cdot024$ respectively, corresponding to $0''\cdot48$ and $0''\cdot58$. Experiments were made in 1872 November by two observers to test whether the position of the eye made any sensible difference in the reading for coincidence of the Collimators, but no such effect was discernible.

Accordingly from 1874, January 1, the discrepancy was accepted as real, and the reading obtained through the central cube was regarded as erroneous to that extent, owing to some cause not sufficiently explained; a correction of $0^{r}\cdot019$ (equivalent to a difference of $0^{r}\cdot023$ in the reading for coincidence of Collimators) being applied to the concluded reading for line of collimation of the Transit Circle micrometer.

The examination of the results of weekly observations in subsequent years confirmed this value of the correction as sensibly constant.

It still remained, however, to satisfactorily explain the discrepancy, and to determine whether the observations made with the Transit Circle raised had been correctly regarded as the standard. It seems very unlikely that the raising of the instrument produces an actual disturbance of either Collimator, for

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the weight of the instrument is still borne by the pillars carrying the pivots. It was suggested

(*a*) That the change of position of such a large mass of metal might cause changes of temperature in the lower portions of the air of the room, and consequently changes in the refraction.

(*b*) That the discordance might be purely optical, either of the nature of diffraction, or due to a difference between the line of collimation of the edges of the Collimator object-glasses and that of the central portions.

As regards diffraction, the symmetry of the arrangement of the holes in the cube about the common axis of the Collimators would appear to obviate the possibility of an unsymmetrical discordance, such as that under consideration.

To discriminate between the other suggestions, in 1885 December a wooden model of the central cube of the Transit Circle was made which could, when the instrument was raised, be placed in the position usually occupied by the central cube, and the South Collimator could be viewed through the corresponding holes in the model cube. If the reading thus obtained for coincidence agreed with that when the instrument was raised and nothing interposed, it would seem that the discordance was due to differences of temperature, while an agreement with the reading taken through the ordinary cube would indicate that the phenomenon must be referred to the cutting off of the central portions of the object-glasses.

The following observations have accordingly been taken with this wooden cube:—

		Readings of North Collimator Micrometer		
Date.	Observer.	Through the ordinary central cube.	Transit Circle raised.	
			Through wooden model cube.	Uninterrupted Vision.
		r.	r.	
1885, Dec. 28	H. T.	·508	·529	·465
		·526	·528	·467
1886, Jan. 6	L.	·490	·531	·481
		·493	·508	·487
Feb. 1	T.	·534	·550	·491
8	A. D.	·572	·557	·542
23	L.	·412	·400	·359
Mar. 8	A. D.	·419	·420	·398
15	H.	·553	·548	·503
22	A. D.	·501	·470	·452
Mean ...	...	... ·501	·504	·465

(The initials H. T., A. D., T., L., H. are those of Mr. Turner, Mr. Downing, Mr. Thackeray, Mr. Lewis, and Mr. Hollis respectively.)

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It would thus appear that the readings obtained through the wooden model are sensibly the same as those obtained through the central cube in the ordinary manner, and that the discrepancy is due to a real difference between the lines of collimation of the central and excentric portions of the object-glasses of the Collimators; and the application of a correction to the "concluded reading for collimation," as deduced from an adjustment of the North Collimator through the cube, is accordingly justified.

With regard to the observations before 1874 which were not so corrected, Sir George Airy remarked that for clock stars and other fundamental stars near the equator, the effect of the correction was merely differential, and therefore almost insensible, and even for other stars is a small quantity.

It may be remarked generally that this investigation suggests that the use of excentric pencils of light in observations of this kind, without proper care, is liable to introduce unexpected errors.

On the Protuberances Visible on the Spectrum with a Narrow Slit.

By E. L. Trouvelot.

At the last meeting of the R.A.S., March 12, Mr. Maunder read a paper containing some criticism on a spectroscopic observation of mine, published in the January number of the *Bulletin Astronomique.* After having described the observation Mr. Maunder said: "I think it is sufficient merely to state this observation to show that there must be some mistake somewhere." Further on he continued: "But the most important thing is that he saw the prominence not only when the slit was open but when it was closed," and he concluded by saying that "the observation was evidently impossible."

If I understand correctly the objections, according to Mr. Maunder, the observation was impossible: 1st, because a protuberance having a certain height, say 3′ 37″, cannot be seen with a slit open wide enough to admit it; and, 2nd, because such a prominence cannot be seen whole with a narrow slit. I must confess that these objections, coming as they do from an experienced observer, have caused me quite a surprise, for the first phenomenon is not so difficult to detect even on ordinary occasions; and the second is not so rare that a diligent observer might not see it at least once or twice in the course of a year. That protuberances projecting upon the spectrum have not yet been seen by Mr. Maunder is quite possible, since these forms of prominences are rare and have usually a short duration; but I am at a loss to understand why he should have failed to see protuberances 3′ high with a wide-open slit, when I can see them so easily, for, I suppose, the instruments he uses for his observations are equal to mine. I will state that in ordinary circumstances—that is, when the sky is passably clear